MULTIMEDIA UNIVERSITY

STUDENT ID NO

MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 3, 2016/2017 SESSION

TCE 1111 – DIGITAL SYSTEMS

(All sections / Groups)

30 MAY 2017
2.30 p.m. to 4.30 p.m.
(2 Hours)

INSTRUCTIONS TO STUDENTS

1. This Question paper consists of 4 printed pages including cover page with **5** questions only.

2. Answer **ALL** questions. All questions carry equal marks and the distribution of the marks for each question is given.

3. Please write all your answers in the Answer Booklet provided.

QUESTION 1

(a) Convert the decimal numbers 6587_{10} and 4398_{10} to Hexadecimal. Solve the addition and subtraction operations on the converted Hexadecimal numbers. [4 Marks]

(b) Solve the following conversions. Show all necessary steps.

(i) Octal 7352_8 to Binary [1 Mark]
(ii) Binary 10110101_2 to Decimal [1 Mark]
(iii) Gray 10011110_{GRAY} to Binary [1 Mark]
(iv) Binary 10111001_2 to Gray [1 Mark]

(c) Given the following logic expression.

$$X = \overline{PQ} + \overline{P}\overline{(Q + \overline{R})} + \overline{P}\overline{R} + \overline{Q(Q + \overline{R})}$$

(i) Simplify X using Boolean laws, rules and theorems. [3 Marks]
(ii) Draw the logic circuit for the simplified expression obtained in (i). [1 Mark]

QUESTION 2

(a) Design a mod-6 asynchronous counter using negative-edge triggered flip-flops. [2 marks]

(b) Express (-11_{10}) as an 8-bit number in the following representation:

(i) Sign-magnitude form [1 Mark]
(ii) 1's complement form [1 Mark]
(iii) 2's complement form [1 Mark]

(c) Design a Half Adder with XOR and AND gate. Your answer should include truth table, Boolean expressions and logic diagram. [3 Marks]

(d) Identify TWO (2) differences between a RAM and a ROM. [2 Marks]

(e) Identify TWO (2) characteristics of a flash memory. [2 Marks]

Continued .....

QUESTION 3

(a) Apply simplification on the following function using Karnaugh Map (K-map). Draw the logic circuit for the simplified logic expression.

$$F(A,B,C,D) = \sum(0,2,3,5,6,7,8,9) \text{ with}$$
$$\textit{Don't Care } D(A,B,C,D) = \sum(10,11,12,13,14,15)$$

Your answer should include

(i) Truth table for function F. [2 Marks]
(ii) SOP expression based on the derived truth table. [1 Mark]
(iii) K-map simplification and simplified SOP expression. [4 Marks]
(iv) Simplified logic circuit. [2 Mark]

(b) Using truth table, demonstrate that a NAND gate is equivalent to a Negative-OR gate. [3 Marks]

QUESTION 4

Based on the given sequence, design a 3-bit Synchronous counter using JK flip flops.

0, 1, 2, 3, 4 and then recycle to 0
Undesired states go to 0

(a) Draw the state transition diagram. [1 Mark]

(b) Derive the PRESENT and NEXT state tabulation (J_C K_C J_B K_B J_A K_A) where C is most significant bit (MSB) and A is least significant bit (LSB). [4 Marks]

(c) Simplify each JK flip-flop input using Karnaugh Map. [4 Marks]

(d) Draw the logic diagram using JK flip-flops for the simplified expressions. [3 Marks]

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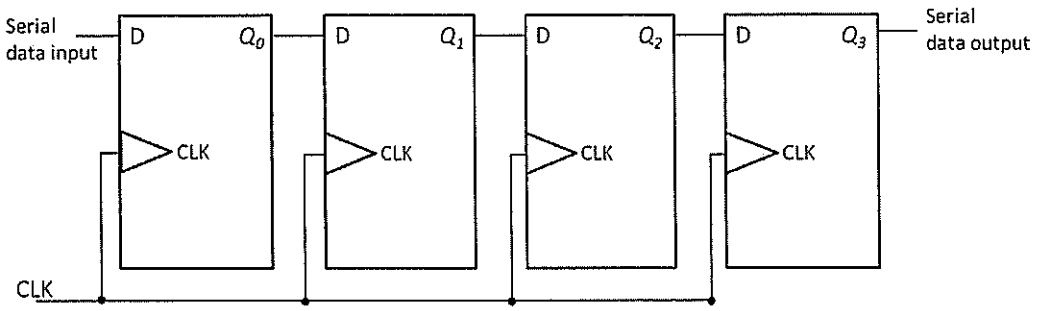
QUESTION 5

(a) Given the input of 11011, devise the states of 4 flip-flops in the following shift register for 5 clock pulses. Assume that the initial state of the shift register is 1111. [3 marks]



(b) Briefly explain the function of $SHIFT/\overline{LOAD}$ input on a 4-bit parallel in serial out shift register. [2 Marks]

(c) Design a Mod-10 Johnson counter with D flip-flops. [3 Marks]

(d) Design the following F function with a suitable multiplexer. Your answer should include truth table and implementation diagram.

$$F(A,B,C) = \sum(1,2,4,5)$$ [4 marks]

End of Paper